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Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Sub-Committee of Experts on the Transport of Dangerous Goods
Forty-fifth session
Geneva,
Item 11 (a) of the provisional agenda
Issues relating to the Globally Harmonized System of Classification and Labelling of Chemicals: desensitized explosives

Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals
Twenty-seventh session
Geneva,
Item 2 (a) (i) of the provisional agenda
Classification criteria and related hazard communication
Work of the Sub-Committee of Experts on the Transport of Dangerous Goods on physical hazards

Implementation of a new Chapter 2.17 "Desensitized Explosives" in the GHS and implementation of "Classification procedures, test methods and criteria relating to the class of desensitized explosives" in a new Part V of the Manual of Tests and Criteria

Transmitted by the expert from Germany[1]

Introduction

1. During the last sessions of the Sub-Committee of Experts on the Transport of Dangerous Goods (TDG Sub-Committee), of the Working Group on Explosives and of the Sub-Committee of Experts on the Globally Harmonized System of Classification and Labelling of Chemicals (GHS Sub-Committee), the proposal for implementation of a new chapter 2.17 "Desensitized Explosives" in the GHS and implementation of "Classification procedures, test methods and criteria relating to the class of desensitized explosives" in a new part of the United Nations Recommendations on the Transport of Dangerous Goods,

[1] In accordance with the programme of work of the Sub-Committee for 2013–2014 approved by the Committee at its twenty-sixth session (see ST/SG/AC.10/C.3/84, para. 86 and ST/SG/AC.10/40, para. 14).

Manual of Tests and Criteria was discussed (Informal documents INF.13 (TDG Sub-Committee, 43rd session) and INF.5 (GHS Sub-Committee, 25th session)).

2. The TDG Sub-Committee noted that the Working Group on Explosives had welcomed and unanimously supported informal document INF.13 (ST/SG/AC.10/C.3/86 para 26).

3. The GHS Sub-Committee concurred in principle with the TDG Sub-Committee on its support for the development of a new hazard class for desensitized explosives in the GHS as mentioned in informal document INF.5 (ST/SG/AC.10/C.4/50, para.10).

4. During the forty-fourth session the TDG-Sub-Committee supported the introduction of the proposed chapter 2.17 in the GHS and agreed to endorse all changes proposed to the GHS and agreed to put the new test method in the Manual of Tests and Criteria between square brackets (ST/SC/AC.10/C.3/88).

5. During the twenty-sixth session the GHS Sub-Committee concurred with the TDG Sub-Committee on the need to include a new chapter in the GHS to address desensitized explosives. The GHS Sub-Committee adopted the proposal in principle and noted editorial or technical comments (ST/SG/AC.10/C.4/52).

6. The expert of Germany prepared this proposal taking into account the very helpful comments from the experts and from the obliging secretaries of both sub-committees and revised the former proposal.

7. The expert from Germany proposes:

(a) To include a new chapter 2.17 "Desensitized Explosives in the GHS", as reproduced in Annex I;

(b) To include a new Part in the Manual of Tests and Criteria containing classification procedures, test methods and criteria relating to the GHS, including a test method for classification of desensitized explosives in four different categories of the GHS, as reproduced in Annex II, on the understanding that it would not be applicable for transport classification.

(c) To amend the Manual of Tests and Criteria and the GHS consequentially as proposed in Annex III.

Annex I

"Chapter 2.17 Desensitized explosives

2.17.1 Definitions and general considerations

2.17.1.1 *Desensitized explosives* are solid or liquid explosive substances or mixtures which are phlegmatized to suppress their explosive properties in such a manner that they do not mass explode and do not burn too rapidly and therefore may be excluded from the hazard class "Explosives" (Chapter 2.1, see also Note 2 of Chapter 2.1.2.2).[1]

2.17.1.2. The class of desensitized explosives comprises:

(a) Solid desensitized explosives are explosive substances or mixtures which are wetted with water or alcohols or are diluted with other substances, to form a homogeneous solid mixture, to suppress their explosive properties.

NOTE: *This includes desensitization achieved by formation of hydrates of the substances.*

(b) Liquid desensitized explosives are explosive substances or mixtures which are dissolved or suspended in water or other liquid substances, to form a homogeneous liquid mixture to suppress their explosive properties.

2.17.2 Classification criteria

2.17.2.1 Any desensitized explosive shall be considered in this class, unless:

(a) It is manufactured with the view to producing a practical, explosive or pyrotechnic effect; or

(b) It has a mass explosion hazard according to Test Series 6 (a) or 6 (b) or their corrected burning rate according to the burning rate test X is too high; or

(c) Their exothermic decomposition energy is less than 300 J/g.

NOTE 1*: Substances or mixtures which meet the criterion (c) may fall within the scope of other hazard classes.*

NOTE 2*: The exothermic decomposition energy may be estimated using a suitable calorimetric technique (see section 20, sub-section 20.3.3.3 in Part II of the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria).*

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[1] Unstable explosives as defined in Chapter 2.1 can also be stabilized by desensitization and consequently may be classified as desensitized explosives, provided all criteria of Chapter 2.17 are met. In this case the desensitized explosive should be tested according to test series 3 (Part I of the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria) because information about its sensitiveness to mechanical stimuli is likely to be important for determining conditions for safe handling and use. The results should be communicated in the safety data sheet.

2.17.2.2 Desensitized explosives shall be classified as packaged for supply and use in one of the four categories of this class depending on the corrected burning rate (A_c) using the test "burning rate test (external fire)" described in Part V, sub-section 51.4 of the United Nations Recommendations of the Transport of Dangerous Goods, Manual of Tests and Criteria, according to Table 2.17.1:

Table 2.17.1: Criteria for desensitized explosives

Category	Criteria
1	Desensitized explosives with a corrected burning rate (AC) equal to or greater than 300 kg/min but not more than 1200 kg/min
2	Desensitized explosives with a corrected burning rate (AC) equal to or greater than 140 kg/min but less than 300 kg/min
3	Desensitized explosives with a corrected burning rate (AC) equal to or greater than 60 kg/min but less than 140 kg/min
4	Desensitized explosives with a corrected burning rate (AC) less than 60 kg/min

NOTE 1: *Desensitized explosives shall be prepared so that they remain homogeneous and do not separate during storage and handling.*

NOTE 2: *Desensitized explosives may be treated differently for some regulatory purposes (e.g. transport). Classification of solid desensitized explosives for transport purposes is addressed in Chapter 2.4, section 2.4.2.4 of the United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations. Classification of liquid desensitized explosives is addressed in Chapter 2.3, section 2.3.1.4 of the Model Regulations.*

NOTE 3: *Explosive properties of desensitized explosives have to be determined by test series 2 of the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, and shall be communicated in the safety data sheet. For testing of liquid desensitized explosives for transport purposes, refer to section 32, sub-section 32.3.2 of the Manual of Tests and Criteria. Testing of solid desensitized explosives for transport purposes is addressed in section 33, sub-section 33.2.3 of the Manual of Tests and Criteria.*

NOTE 4: *For the purposes of storage, supply and use, desensitized explosives do not fall additionally within the scope of chapters 2.1 (explosives), 2.6 (flammable liquids) and 2.7 (flammable solids).*

NOTE 5: *These classification criteria reference the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, but do not reference the GHS criteria on testing the mixture as a whole (see 1.3.2.3(a)).*

2.17.3 Hazard communication

General and specific considerations concerning labelling requirements are provided in *Hazard communication: Labelling* (Chapter 1.4). Annex 1 contains summary tables about classification and labelling. Annex 3 contains examples of precautionary statements and pictograms which can be used where allowed by the competent authority.

Table 2.17.2: Label elements for desensitized explosives

	Category 1	Category 2	Category 3	Category 4
Symbol	Flame	Flame	Flame	Flame
Signal word	Danger	Danger	Warning	Warning
Hazard statement	Desensitized explosive; Fire, blast or projection hazard	Desensitized explosive; Fire or projection hazard	Desensitized explosive; Fire or projection hazard	Desensitized explosive; Fire hazard

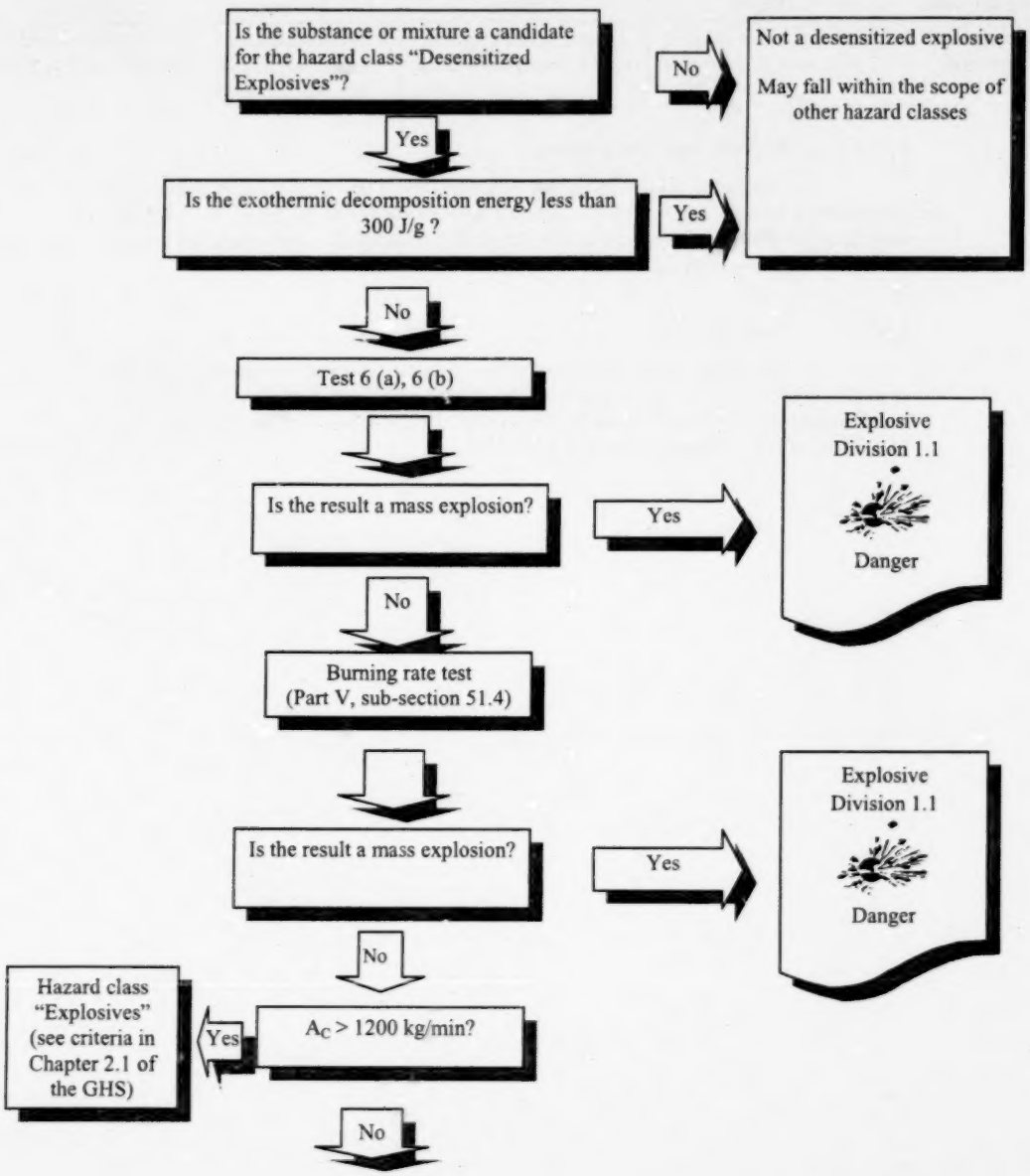
2.17.4 Decision logic and guidance

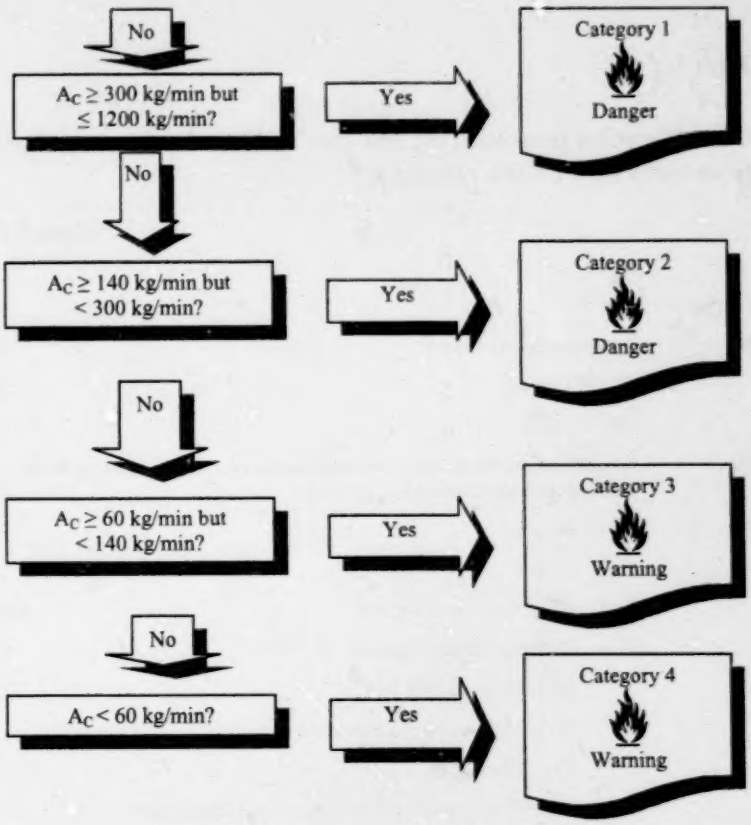
The decision logic and guidance which follow are not part of the harmonized classification system, but have been provided here as additional guidance. It is strongly recommended that the person responsible for classification studies the criteria before and during use of the decision logic.

2.17.4.1 Decision logic

To classify desensitized explosives, data for the explosive potential and the corrected burning rate has to be determined as described in Part V *of the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria*. Classification is according to decision logic 2.17.1.

Decision logic 2.17.1 for desensitized explosives





2.17.4.2 Guidance

2.17.4.2.1 The classification procedure for desensitized explosives does not apply if:

(a) The substances or mixtures contain no explosives according to the GHS criteria in Chapter 2.1; or

(b) The exothermic decomposition energy is less than 300 J/g.

2.17.4.2.2 The exothermic decomposition energy should be determined using the explosive already desensitized (i.e.: the homogenous solid or liquids mixture formed by the explosive and the substance(s) used to suppress its explosive properties). The exothermic decomposition energy may be estimated using a suitable calorimetric technique (see Section 20, sub-section 20.3.3.3 in Part II of the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria)."

Annex II

Part V

Classification procedures, test methods and criteria relating to sectors other than transport

Contents of Part V

Section		Page
50.	**Introduction to Part V**	XX
	50.1 Purpose	XX
	50.2 Scope	XX
51.	**Classification procedures, test methods and criteria relating to the hazard class desensitized explosives**	XX
	51.1 Purpose	XX
	51.2 Scope	XX
	51.3 Classification procedure	XX
	51.4 Burning rate test (external fire) (D)	XX
	51.4.1 Introduction	XX
	51.4.2 Apparatus and materials	XX
	51.4.3 Procedure	XX
	51.4.4 Test criteria and method of assessing results	XX
	51.4.5 Examples of results	XX
	51.4.6 Example of calculation	XX

"Section 50

Introduction to Part V

50.1 Purpose

Part V of the Manual presents the United Nations schemes for the classification of desensitized explosives for supply and use (including storage) according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

50.2 Scope

The test methods of this Part should be applied when required by the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).".

"Section 51

Classification procedures, test methods and criteria relating to the hazard class desensitized explosives

51.1 Purpose

51.1.1 This section presents the United Nations scheme of the classification of liquid and solid desensitized explosives see Chapter 2.17 of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)). The text should be used in conjunction with the classification principles of Chapter 2.17 of the GHS and the test series given in sub-sections 16.4 and 16.5 of this Manual.

For testing of liquid desensitized explosives for transport purposes, refer to section 32, sub-section 32.3.2 of this Manual. Testing of solid desensitized explosives for transport purposes is addressed in section 33, sub-section 33.2.3 of this Manual, Chapter 2.4, sub-section 2.4.2.4 of the United Nations Recommendations on the Transport of Dangerous Goods, Model Regulations (for solid desensitized explosives) and in Chapter 2.3, sub-section 2.3.1.4 of the Model Regulations (for liquid desensitized explosives).

51.2 Scope

51.2.1 Desensitized explosives are solid or liquid explosive substances or mixtures which are phlegmatized to suppress their explosive properties in such a manner that they may be excluded from the hazard class "Explosives" (Chapter 2.1 of GHS). Desensitized explosives, should be first tested according to the tests series 1 (type 1(a)), 2 and 6 (type (a) and (b), respectively) of this Manual[1] .

[1] Unstable explosives as defined in Chapter 2.1 can also be stabilized by desensitization and consequently may be classified as desensitized explosive, provided all criteria of chapter 2.17 are met. In this case the desensitized explosive should be tested according to test series 3 (Part I of this Manual) because information about its sensitiveness to mechanical stimuli is likely to be important for determining conditions for safe handling and use. The results should be communicated in the safety data sheet.

51.2.2 The appropriate classification procedures for desensitized explosives should be undertaken before they are offered for supply and use unless:

(a) They are manufactured with the view to producing a practical, explosive or pyrotechnic effect;

(b) They have a mass explosion hazard according to Test Series 6(a) or 6(b) or their corrected burning rate according to the burning rate test 51.4 is too rapidly;

(c) Their exothermic decomposition energy is less than 300 J/g[2].

51.3 Classification procedure

51.3.1 Before packaged substances or mixtures are subjected to the burning rate test, the test series 6 types 6 (a) and 6 (b) shall be performed in alphabetical order. The substances or mixtures should be tested first with a standard detonator (Appendix 1 of the Manual) and, if no explosion occurs, with an igniter just sufficient (but not more than 30 g of black powder) to ensure ignition of the substance or mixture in the packaging. The initiation system giving a positive result in the 6 (a) test should be used for the 6 (b) test.

51.3.2 However, it is not always necessary to conduct tests of all types. Test type 6 (b) may be waived if in each type 6 (a) test:

(a) The exterior of the package is undamaged by internal detonation and/or ignition; or

(b) The contents of the package fail to explode, or explode so feebly as would exclude propagation of the explosive effect from one package to another in test type 6(b).

51.2.3 If a substance or mixture gives a negative result (no propagation of detonation) in the Series 1 type 1(a) test, the 6(a) test with a detonator may be waived[3]). If a substance or mixture gives a negative result (no or slow deflagration) in a Series 2 type 2(c) test, the 6 (a) test with an igniter may be waived.

51.2.4 The test for determination of the burning rate by large-scale test need not be performed if, in a test type 6 (b), there is practically instantaneous explosion of virtually the total contents of the stack. In such cases the product is assigned to Division 1.1.

51.4 Burning rate test (external fire)

51.4.1 ***Introduction***

51.4.1.1 The test method for determination of the burning rate (10 000 kg scale burning rate) is to be used to determine the behaviour of substances or mixtures as packaged for storage and use if involved in an external fire. This test is performed with several packages of the substances or mixtures to determine

(a) Whether there is a mass explosion hazard, a hazard from dangerous projection or a too violent burning,

(b) A burning rate (10 000 kg scaled), which depends on the total mass.

[2] The exothermic decomposition energy should be determined using the explosive already desensitized (i.e.: the homogenous solid or liquids mixture formed by the explosive and the substance(s) used to suppress its explosive properties). The exothermic decomposition energy may be estimated using a suitable calorimetric technique (see Section 20, sub-section 20.3.3.3 in Part II of this Manual)

[3] If the type 1 (a) test is not carried out the Series 6 type 6(a) test cannot be waived.

51.4.1.2 The burning rate is defined as the extrapolated burning rate for a mass of 10 000 kg packaged material. In practice, this burning rate is determined using both a single package and stacks of packages, following by an extrapolation procedure. The tests are performed with the substances or mixtures in the packages as provided for storage and use. All types of packages are subjected to the tests unless:

(a) A substance or mixture, as packed for supply and use, may be unambiguously assigned to a burning rate and category by a competent authority on the basis of results from other tests or of available information; or

(b) The substance or mixture, as packed for supply and use, is assigned to the hazard class "Explosives", Division 1.1.

51.4.1.3 The corrected burning rate (10 000 kg scaled) is to be used for classification into four different categories.

51.4.2 ***Apparatus and materials***

51.4.2.1 The test should be applied to packages of substances or mixtures in the condition and form in which they are offered for supply and use (including storage). The following elements are needed:

(a) A number of 1, 6 and 10 packages, with a net mass of desensitized explosive of 25 kg in each package;

(b) A number of 1, 3 and 6 packages, with a net mass of desensitized explosive between 25 kg and 50 kg in each package;

(c) A number of 1 and up to six packages, , with a net mass of desensitized explosive of more than 50 kg, the total net mass should not be greater than 500 kg;

(d) One or two trays with an adequate size and height to contain the wooden pallets and the packages and to protect the ground;

(e) Wooden pallets (e.g. according to DIN 15146), with wood-wool distributed between, under and above the packages;

(f) A suitable ignition source guaranteeing the ignition of the wooden pallets/wood-wool and consequently the tested packages (a mixture of gasoline and light fuel oil 10/90 evenly distributed over the packages and the wood-wool is recommended);

(g) Cine and/or video cameras and suitable equipment to measure the heat of radiation, e.g. infrared sensors and/or thermo cameras.

51.4.2.2 The number of tests and/or the total mass (whereas necessary) should be increased if the test results are ambiguous and the corresponding hazards cannot be clearly defined.

51.4.3 ***Procedure***

51.4.3.1 The tests start with a single package and then the number of packages are successively increased as mentioned under 51.4.2.1 (a), (b) or (c). Normally the burning rate test should be performed once for each number of packages. The required numbers of packages, in the condition and way in which they are offered for supply and use (including storage), are arranged in such way, that the most severe results are anticipated, on wooden and leveled pallets. The pallets are placed in one (or two, if necessary) trays. A tray must comprise at least one complete pallet including 10 cm open space all around the pallet.

Flammable material (wood-wool, paper, etc.) is placed under and around the packages in such a way that an optimum ignition is guaranteed (see 51.4.2.1 (f)).

***NOTE**: A quantity of about 10 kg dry wood-wool is usually sufficient. The wooden pallets and the dry wood-wool shall be soaked with a liquid mixture of fuel (about 10 liter, see 51.4.2.1 (f)).*

51.4.3.2 The heat of radiation is measured during the test by suitable equipment, at least at three locations with three different distances from the seat of fire (the distances depend on the sensitivity of the equipment (sensors, thermo camera, etc.) and should be calculated before the test.

51.4.3 The signals are continuously recorded. The starting-point of the fire outbreak is defined as the moment when a reaction of the substance is detected. The end of the fire is determined from registered radiation curves.

51.4.3.4 If a mass explosion or individual explosions or metallic projections (fragments) are observed this should be noted in the test report.

51.4.4 ***Test criteria and method of assessing results***

51.4.4.1 The burning rates A and A_{10t} are determined as follows:

(a) The starting point of the fire is defined as the moment at which the substance or mixture reacts detectably. The end of the fire is characterized by a decrease in radiation level I (as caused by the fire) to less than 5 % of the maximum level (I_{max}) (see Figure 51.4.1);

(b) The effect of either remainder or burning materials, if present, shall be taken into account in the evaluation;

(c) The burning time t is the time span between the starting point and the end of the fire;

(d) The burning rate A [kg/min] can be calculated for each tested quantity m [kg] and its corresponding burning time t [min] from the equation:

$$A = \frac{m}{t}$$

(e) Log A is plotted against log m, where A is the determined burning rate, and m is the mass of substance or mixture used for the test. The observed test results are extrapolated by means of this graph to an uncorrected burning rate A_{10t} for a mass of 10 000 kg by applying of the formula:

$$A_{10t} = \left(\frac{10000\ kg}{m}\right)^{\frac{2}{3}} \cdot A$$

51.4.4.2 The corrected burning rate A_C is determined as follows:

(a) The internal amount of energy of the substance is partially converted into radiation. The percent average radiation efficiency η at a distance from the fire is determined from the measured radiation level ($dose_{measured}$) and the theoretical maximum energy ($dose_{calculated}$);

$$\eta = \frac{dose_{measured}}{dose_{calculated}}$$

(b) The theoretical maximum energy is calculated by multiplying the individual mass of tested substance m [kg] with the heat of combustion H_v [kJ/kg][4]

$$dose_{calculated} = H_v \cdot m$$

(c) The amount of energy that in practice appears to be transferred by radiation is determined by integrating the area below the measured radiation curve;

$$dose_{measured} = f(t) = \left[\sum_{t=start}^{end} \frac{(I_{(t+\Delta t)} + I_t}{2} \cdot \Delta t \right] \cdot 4\pi \cdot r^2$$

The numerical integration of the radiation intensities I_t [W/m^2] over the total burning time delivers $dose_{measured}$ [kJ] at the distance r [m].

(d) To this end a graph is made showing the radiation level I [kW/m^2] as a function of time. The complete radiation dose is calculated by integration of the smoothed and corrected curve down to 1 % to 5 % of I_{max};

(e) $I_{relevant}$ is obtained from the maximum of the curve of heat radiation calculated as average value of the radiation by converting the integrated area in a rectangle of equal size during the same time span;

(f) The form factor f that must be taken into account during the maximum fire intensity can be averaged from the formula:

$$f = \frac{I_{relevant}}{I_{calculated}}$$

(g) The corrected burning rate A_c is calculated as follows:

$$A_c = A_{10t} \cdot \frac{H_v}{33500} \cdot \frac{\eta}{0.25} \cdot \frac{f}{2.78}$$

Where H_v is the heat of combustion of the substance [kJ/kg] (i.e. reaction enthalpy of the burning reaction); η is the radiation efficiency and f the form factor. A_C is the corrected burning rate [kg/min] for a quantity of 10 000 kg.

51.4.4.3 If a mass explosion or individual explosions or metallic projections (fragments) occur the substance or mixture is classified in the hazard class "explosives".

51.4.4.4 The test results are assessed on the basis of the corrected burning rate A_C for a quantity of 10 000 kg of the packaged substance or mixture.

51.4.4.5 The test criteria for determining the burning behavior of substances or mixtures are:

Category 1: Any substance or mixture with a corrected burning rate A_C equal to or greater than 300 kg/min but not more than 1200 kg/min;

Category 2: Any substance or mixture with a corrected burning rate A_C equal to or greater than 140 kg/min but less than 300 kg/min;

[4] Should be determined by a suitable technique e.g. combustion calorimeter.

Category 3: Any substance or mixture with a corrected burning rate A_C equal to or greater than 60 kg/min but less than 140 kg/min;

Category 4: Any substance or mixture with a corrected burning rate AC less than 60 kg/min.

Any substance or mixture with a corrected burning rate greater than 1200 kg/min is classified as an explosive (See Chapter 2.1 of the GHS).

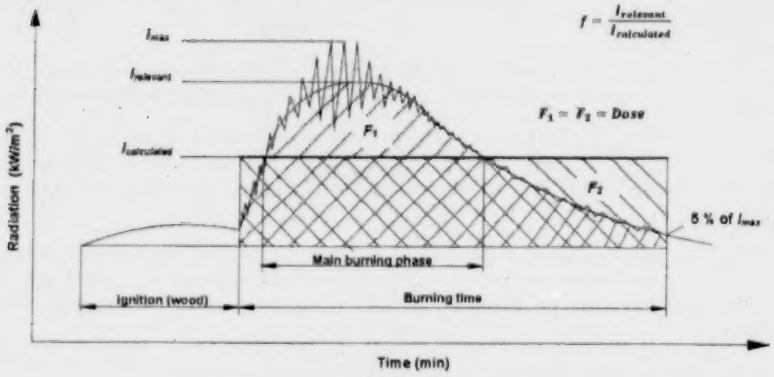


Figure 51.4.1: Measurement of radiation as a function of time

51.4.5 *Examples of results*

51.4.5.1 The nitrocellulose formulations are packed in fiber drums (1G) with a maximum mass of 140 kg and fiber board boxes (4G) with a maximum mass of 25 kg, assigned to categories as follows:

(a) Ester soluble (E-grades) nitrocellulose formulations with different phlegmatizers and a nitrogen content of 11.8 % to 12.3 %

NC-type	IPA 35%	IPA 30%	ETH 35%	ETH 30%	BUT 35%	BUT 30%	Water	Chips[a)]
12E	3	2	4	3	2	1 (330 kg/min)	4	1 (1115 kg/min)
22E	3	3	4	3	3	3	4	1 (1115 kg/min)
25E	3	3	4	3	3	3	3	1 (1115 kg/min)

IPA (Isopropanol), ETH (Ethanol), BUT (Butanol),
[a)] NC-Chips with 20 % plasticizer

(b) Medium soluble (M-grades) nitrocellulose formulations with different phlegmatizers and a nitrogen content of 11.3 % to 11.8 %

NC-type	IPA 35%	IPA 30%	ETH 35%	ETH 30%	BUT 35%	BUT 30%	Water	Chips[a)]
15M	-	-	-	-	3	2	-	
27M	3	3	4	4	3	3	4	1 (1115 kg/min)
34M	3	3	4	4	4	-	-	1 (1115 kg/min)

IPA (Isopropanol), ETH (Ethanol), BUT (Butanol),
[a)] NC-Chips with 20 % plasticizer

(c) Alcohol soluble (A-grades) nitrocellulose formulations with different phlegmatizers and a nitrogen content of 10.7 % to 11.3 %

NC-type	IPA 35%	IPA 30%	ETH 35%	ETH 30%	BUT 35%	BUT 30%	Water	Chips[a)]
15A	4	3	4	3	3	2	-	1 (1115 kg/min)
30A	4	3	4	4	3	3	4	1 (1115 kg/min)
32 A	4	3	4	4	4	3	-	-

IPA (Isopropanol), ETH (Ethanol), BUT (Butanol),
[a)] NC-Chips with 20 % plasticizer

51.4.6 ***Example of a calculation***

NC-formulation (nitrogen content 10.7 % to 11.2 %) wetted with 30 % isopropanol:

Mass of the tested NC formulation: $m = 285$ kg
Burning time: $t = 9.7$ min
Form factor: $f = 3.73$
Radiation efficiency: $\eta = 0.24$
Enthalpy of combustion: $H_v = 15626$ kJ/kg

Calculation of the burning rate A:

$$A = \frac{m}{t} = \frac{285\ kg}{9.7\ min} = 29.4\ \frac{kg}{min}$$

Calculation of the burning rate A_{10t}:

$$A_{10t} = \left(\frac{10000\ kg}{m}\right)^{\frac{2}{3}} \cdot A = \left(\frac{10000\ kg}{285\ kg}\right)^{\frac{2}{3}} \cdot 29.4\ \frac{kg}{min} = 315\ \frac{kg}{min}$$

Calculation of the corrected burning rate A_c:

$$A_c = A_{10t} \cdot \frac{H_v}{33500} \cdot \frac{\eta}{0.25} \cdot \frac{f}{2.78} = 315\ \frac{kg}{min} \cdot \frac{15626\ \frac{kJ}{kg}}{33500\ \frac{kJ}{kg}} \cdot \frac{0.24}{0.25} \cdot \frac{3.73}{2.78} = 169\ \frac{kg}{min}$$

The desensitized explosive is classified in category 2."

References

[1] German "Guideline for the assignment of substances which may show explosive properties to Storage Groups (SprengLR011)"

[2] Thermal radiation hazards from organic peroxides, Roberts, T.A. and Merrifield, R., J. Loss. Prev. Process Ind. 1990, 3, 244.

[3] Thermal radiation hazard and separation distances for industrial cellulose nitrate, Roberts, T.A. and Merrifield, R., J. Loss. Prev. Process Ind. 1992, 5,311.

[4] Storage of Organic Peroxides, Publication Series on Dangerous Substances 8 (PGS 8), Ministries of Social Affairs and of the Interior, The State Secretary of Housing, Spatial Planning and Environment (VROM), The Netherlands 2006.

[5] The storage and handling of organic peroxides, Guidance Note CS21, Health and Safety Executive, 1998, United Kingdom

Annex III

Consequential amendments

A. GHS

1. In the TABLE OF CONTENTS, under Part 2. Insert: "Chapter 2.17, Desensitized explosives:

2. In chapter 1.2 add the following definition for desensitized explosives:

"***Desensitized explosives*** mean solid or liquid explosive substances or mixtures which are phlegmatized to suppress their explosive properties in such a manner that they do not mass explode and do not burn too rapidly and therefore may be excluded from the hazard class "Explosives" (see Chapter 2.1; see also Note 2 to paragraph 2.1.2.2)."

3. Amend Note 2 to paragraph 2.1.2.2 to read as follows:

"NOTE 2: Some explosives substances and mixtures are wetted with water or alcohols, diluted with other substances or dissolved or suspended in water or other liquid substances to suppress or reduce their explosive properties. They may be a candidate for classification as desensitized explosives (see chapter 2.17) or may be treated differently from explosive substances and mixtures (as desensitized explosives) for some regulatory purposes (e.g. transport) see 1.3.2.4.5.2."

4. In Annex I, insert a new Table A1.17 for the new hazard class "Desensitized explosives" as follows:

"A1.17 **Desensitized explosives** (see Chapter 2.17 for classification criteria)

Classification		**Labelling**				
Hazard class	**Hazard category**	**Pictogram**		**Signal word**	**Hazard statement**	**Hazard statement Codes**
		GHS	**UN Model Regulations**			
Desensitized explosives	1		*Not applicable*	**Danger**	Desensitized explosive; Fire, blast or projection hazard	H206
	2		*Not applicable*		Desensitized explosive; Fire or projection hazard	H207
	3		*Not applicable*	**Warning**	Desensitized explosive; Fire or projection hazard	H207
	4		*Not applicable*		Desensitized explosive; Fire hazard	H208

NOTE: *Classification and labelling of desensitized explosives are addressed in transport regulations in a different way. In transport, solid desensitized explosives are classified in Division 4.1 (flammable solids) and shall bear a Division 4.1 label. (See: Chapter 2.4, section 2.4.2.4 of the United Nations Recommendations on the*

Transport of Dangerous Goods, Model Regulations). Liquid desensitized explosives are classified in Class 3 (flammable liquids) for transport purposes and shall bear a Class 3 label (see, Chapter 2.3, section 2.3.1.4 of the Model Regulations)."

5. In Annex 3, Section 1, Table A3.1.1, insert the following physical hazard statements:

Code (1)	Physical hazard statements (2)	Hazard class (GHS chapter) (3)	Hazard category (4)
H206	Desensitized explosive; Fire, blast or projection hazard	Desensitized explosives (chapter 2.17)	1
H207	Desensitized explosive; Fire or projection hazard	Desensitized explosives (chapter 2.17)	2, 3
H208	Desensitized explosive; Fire hazard	Desensitized explosives (chapter 2.17)	4

6. In Annex 3, Section 2, Table A3.2.2:

P212

Insert the following new precautionary statement

Code (1)	Prevention precautionary statements (2)	Hazard class (3)	Hazard category (4)	Conditions for use (5)
P212	**Avoid heating under confinement or reduction of the phlegmatizer due to the risk of explosion.**	Desensitized explosives (chapter 2.17)	1, 2, 3, 4	

P230

Amend the condition for use to read as follows:

"- *For substances and mixtures which are wetted, diluted, dissolved or suspended with a phlegmatizer in order to reduce their explosive properties*

Manufacturer/supplier or the competent authority to specify appropriate material".

7. In Annex 3, Section 2, table A.3.2.2, apply the following precautionary statements to desensitized explosives as follows:

P210

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard categories "1, 2, 3, 4"

P230

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard categories "1, 2, 3, 4" with the condition for use: "...Manufacturer/supplier or the competent authority to specify appropriate material"

P233

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard categories "1, 2, 3, 4"

P280

Insert a new row for the hazard class "Desensitized explosives (Chapter 2.17)" applicable to hazard categories "1, 2, 3, 4" with the condition for use: "Manufacturer/supplier or the competent authority to specify he appropriate type of equipment"

8. In Annex 3, Section 2, table A.3.2.3, apply the following precautionary statements to desensitized explosives as follows:

P370

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard categories "1, 2, 3"

P371

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard category "4"

P375

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard categories "1,2,3"

P380

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard categories "1, 2, 3, 4"

P370 + P380 + P375

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard categories "1, 2, 3"

P371 + P380 + P375

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard category "4"

9. In Annex 3, Section 2, table A.3.2.4 apply the following precautionary statement to desensitized explosives as follows:

P401

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard categories "1, 2, 3, 4" with the condition for use: "…Manufacturer/supplier or the competent authority to specify local/regional/national/international regulations as applicable."

10. In Annex 3, Section 2, table A.3.2.5 apply the following precautionary statement to desensitized explosives as follows:

P501

Insert a new row for the hazard class "Desensitized explosives (chapter 2.17)" applicable to hazard categories "1, 2, 3, 4" with the condition for use: "... in accordance with local/regional/national/international regulations (to be specified). Manufacturer/supplier or the competent authority to specify whether disposal requirements apply to content, container or both."

11. In Annex 3, Section 3 inserts the following new tables:

DESENSITIZED EXPLOSIVES
(Chapter 2.17)

Symbol
Flame

Hazard category	**Signal word**	**Hazard statement**	
1	Danger	H206	Desensitized explosive; Fire, blast or projection hazard
2	Danger	H207	Desensitized explosive; Fire or projection hazard
3	Warning	H207	Desensitized explosive; Fire or projection hazard

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
P210 **Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.** P212 **Avoid heating under confinement or reduction of the phlegmatizer due to the risk of explosion.** P230 **Keep wetted with...** ...Manufacturer/supplier or the competent authority to specify appropriate material. P233 **Keep container tightly closed** P280 **Wear protective gloves/protective clothing/eye protection/face protection**	P370+P380+P375 **In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion**	P401 **Store in accordance with...** ...Manufacturer/supplier or the competent authority to specify local/regional/ national/international regulations as applicable.	P501 **Dispose of contents/containers to...** ...in accordance with local/regional/national /international regulations (to be specified). Manufacturer/supplier or the competent authority to specify whether disposal requirements apply to contents, container or both.

DESENSITIZED EXPLOSIVES
(Chapter 2.17)

Symbol
Flame

Hazard category	Signal word	Hazard statement	
4	Warning	H208	Desensitized explosive; Fire hazard

Precautionary statements			
Prevention	**Response**	**Storage**	**Disposal**
P210 **Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.** P212 **Avoid heating under confinement or reduction of the phlegmatizer due to the risk of explosion.** P230 **Keep wetted with…** ...Manufacturer/supplier or the competent authority to specify appropriate material. P233 **Keep container tightly closed** P280 **Wear protective gloves/protective clothing/eye protection/face protection**	P371+P380+P375 **In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion**	P401 **Store in accordance with…** …Manufacturer/supplier or the competent authority to specify local/regional/ national/international regulations as applicable.	P501 **Dispose of contents/containers to…** …in accordance with local/regional/national /international regulations (to be specified). Manufacturer/supplier or the competent authority to specify whether disposal requirements apply to contents, container or both.

B. Manual of Tests and Criteria

12. Under "General Table of contents" insert:

"PART V: Classification procedures, test methods and criteria relating to sectors other than transport

50. Introduction to Part V (Purpose, Scope)

51. Classification procedures, test methods and criteria for supply and use (including storage) relating to the hazard class "desensitized explosives"."

13. Insert in section 32.3.2 a new sub-section 32.3.2.4 to read as follows:

"32.3.2.4 The classification scheme of liquid desensitized explosives for supply and use (including storage) according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) is referred to section 51."

14. Insert in section 33.2.3 a new sub-section 33.2.3.4 to read as follows:

"33.2.3.4 The classification scheme of solid desensitized explosives for supply and use (including storage) according to the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) is referred to section 51.".